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Increased Copper Surface Stability in Solutions

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Abstract – Pronounce copper protection is attributed to the growth of protective film on copper surface, containing both copper oxides and copper organic/inorganic compounds. It is suggested that the organic/inorganic molecules enhance copper protection by covering copper oxides with a thin and dense layer, which prevents water molecules or aggressive anions interaction with the copper surface.

The ability of dissolved organic and inorganic salts to produce surface passivation and to inhibit aqueous corrosion of copper is discussed. The electrochemical measurements indicate that the inhibiting efficiency of these compounds generally depends on their chemical binding “head” to the oxide covering the metal surface.

The organic salts, [fatty acid salts with a general formula $C_{n-1}H_{2n-1}COOK$ or C_nK (n = 3…12)], protection capabilities are dependent on the hydrocarbon chain length. Inhibiting efficiency was higher for a longer hydrocarbon chain of fatty acid. Degree of copper protection was found to increase with an increase in fatty acid salt concentration. The protective layer formed at the copper surface subsequent to exposure in various salt solutions were characterized by contact angle measurements, electrochemical impedance spectroscopy, X-ray photoelectron and Fourier transform infrared reflection spectroscopies.

Pronounce copper protection was attributed to the growth of protective film on copper surface, containing both copper oxides and copper organic/inorganic compounds. It is suggested that the organic/inorganic molecules enhance copper protection by covering copper oxides with a thin and dense layer, which prevents water molecules or aggressive anions interaction with the copper surface. Such copper surface protection is proven to be beneficial in microelectronic wet processes.